



Closeout Report on the DOE/SC Status Review of the Utilities Upgrade Project (UUP) Fermi National Accelerator Laboratory July 19-20, 2016

**Raymond Won
Committee Chair**

Office of Science, U.S. Department of Energy

<http://www.science.doe.gov/opa/>



Review Committee Participants

Raymond Won, DOE/SC, Chairperson

Review Committee

Subcommittee 1—Technical

*Shane Wells, SLAC
Pat Hogan, ANL

Subcommittee 2—ES&H

*Dan Edwards, PNNL
Mike Ratelle, SLAC

Subcommittee 3—Cost and Schedule

*Kelly Krug, TJNAF
Laurie Casarole, BNL
Jesse Saldivar, DOE/SSO

Subcommittee 4—Project Management

*Rusty Sprouse, TJNAF
Teresa Danforth, TJNAF
Machelle Vieux, SLAC

*Lead

Observers

Stephanie Short, DOE/SC
David Michlewicz, DOE/SC
Steve Neus, DOE/FSO



1. General: Is the project's technical, cost and schedule performance consistent with the Project Execution Plan (PEP) established at CD-3b? Has the project responded appropriately to recommendations from prior reviews? Are there lessons learned from problems encountered during project construction (e.g., lock-out/tag-out and tunneling) that could be shared with the SLI community?
2. Technical: Do contingency spend-down alternatives conform to the approved project scope and key performance parameters, and are they prioritized? Is technical performance adequate and properly managed?
3. ES&H: Are ES&H systems and processes in place to support the mitigation of all identified hazards and to ensure delivery of the project in a safe and environmentally sound manner? Is ES&H performance adequate and properly managed?
4. Cost and Schedule: Is the project performance in line with the approved performance baseline, and are variances being effectively managed? Is the cost and schedule contingency adequate to complete approved work prior to CD-4? Are project schedules resource loaded and managed for effective performance reporting?
5. Management: Is the project properly managed for successful completion? Is a contingency spend-down plan developed and executable by CD-4? Are contingency spend-down alternatives prioritized? Is the risk register updated to reflect approved scope enhancements, and are future updates adequately mature for high priority contingency spend-down alternatives?



1. General: Is the project's technical, cost and schedule performance consistent with the Project Execution Plan (PEP) established at CD-3b? **YES** Has the project responded appropriately to recommendations from prior reviews? **YES** Are there lessons learned from problems encountered during project construction (e.g., lock-out/tag-out and tunneling) that could be shared with the SLI community? **YES**
2. Technical: Do contingency spend-down alternatives conform to the approved project scope and key performance parameters, and are they prioritized? **YES** Is technical performance adequate and properly managed? **YES**



- Meeting all Level 1 milestones; 1 level 2 milestone was adjusted by BCR to accommodate operational conflict; significant adjustments made to level 3 milestones in latest BCR
- The project has a fully executed contract modification with ABB that defines May 2016 as the required delivery date for the ABB MSS; the project has experienced a two month delay relative to the May date
- The MSS is late due to quality control/production issues involving the integration of the building with the switching equipment
- The effect of the delay has been mitigated by shipping prior to completion of all punch list issues to allow integration contractor to continue their work; issues will be addressed on site and prior to site acceptance testing
- Site visits were held to inspect building and gear separately and they held weekly status updates with ABB during the offsite assembly of the MSS
- All systems will now be tested again by ABB on site



- Initiated daily meetings with ABB and integrated Meade and ABB schedules
- ABB responsible for correct wiring and turning on AC system, Meade responsible for programming and commissioning
- ABB is scheduled to complete their work on 8/4 and Com Ed is scheduled to start on 8/15 to install equipment, and are on board for the 12/15 energization and commissioning start
- Meet with Com ED every 2 weeks to integrate schedules
- Com ED is being very proactive about supporting the lab including reducing vulnerabilities introduced by being on single source



- 75% of the ICW backbone piping is in place with the remainder shifted toward the end of the project to accommodate operations
- Weekly coordination meetings are being held for the ICW project for schedule and logistics
- Unit prices locked on piping work
- Existing contract in place to mitigate and dispose of any transite pipe
- The existing Casey's Pond pump house has flooded 6 times over its lifetime, reaching the electrical equipment in the pump room
- Bids received for the Casey's Pond Electrical Room Addition on 7/15; technical review is not complete; bids are within the \$1.5M budget
- A prioritized spend down plan is in place
- Risk contingency is \$1.2M – includes buy down items



- Overall the project is going well and the challenges that are arising are being handled well, there is little to no risk of not completing threshold KPP's and two of the objective KPP's are under contract.
- It would have benefited the project to learn of the ABB MSS delay earlier; On future projects with equipment as significant to the project as the MSS is to this one, Fermi may consider more in-progress factory visits, such as at 50% completion of the integration, in addition to the factory acceptance inspection visit.
- There is a mitigation available for the MSS if ABB is delayed in that Meade and Com ED could do their work while ABB is still on site completing their work.
- The most complex parts of the ICW piping is complete, still some challenges to go, but lower risk than work already complete.



- Need to identify the all the schedule constraints to the Casey's Pond Electrical Room Addition and further detail the retirement profile of the construction risk prior to BCR for this scope.
- Applying a unit price contract approach to the ICW work is a best practice, well-suited for work that involves such potential for unforeseen underground conditions.
- The project has coordinated extensively with site operations and science regarding the modified site power supply approach and ICW outages required to execute the project, and the possible but unlikely major interruptions related to the project's work .
- Extensive potholing during the design phase is a best practice for any underground utility project routing through an area with significant potential underground conflicts.



- None



1. **General**: Is the project's technical, cost and schedule performance consistent with the Project Execution Plan (PEP) established at CD-3b? Has the project responded appropriately to recommendations from prior reviews? Are there lessons learned from problems encountered during project construction (e.g., lock-out/tag-out and tunneling) that could be shared with the SLI community? **YES**

3. **ES&H**: Are ES&H systems and processes in place to support the mitigation of all identified hazards and to ensure delivery of the project in a safe and environmentally sound manner? Is ES&H performance adequate and properly managed? **YES**



- **Findings**

- Recommendations from the previous review have been implemented (e.g., full-time onsite safety support by all subs has been implemented).
- Project has maintained a very good safety record (DART = 0, TRCR = 0) and is implementing safe work practices.
- 1 ORPS reportable on the project to date, with the project ~61% complete.
- Project has an engaged and experienced team overseeing construction.
- Fermi S&H staff supporting construction are not funded by the project, resource allocation is tracked at a level of ~1FTE overall.
- Fermi construction management and support staff (e.g., S&H, GIS, fire safety, etc.) are integrated in the status/2 week look-ahead contractor meetings as part of work planning.
- S&H is integrated in the management change process (hazard analysis) and turnover to beneficial occupancy.
- System outages are planned, communicated, and coordinated with FES, building management, and R&D. Clear lines of communication have been established and contingencies have been implemented.



- **Comments**

- Lessons learned are being communicated from UUP to operations and vice versa (e.g., LOTO improvements at Fermi from UUP ORPS event, 10CFR851 Worker Safety and Health requirements in construction/UUP procurements, update of GIS for discovered field conditions). Continue to implement contractual flowdown of requirements and implementation in the field.
- Field observations are captured in Predictive Solutions system, the data is used to track/trend and identify issues early.
- Integration of subcontractor work in overlapping areas (e.g., MSS) is a concern that is being adequately addressed by construction management and the subcontractor.
- Remain diligent on ES&H aspects as you approach the finish line (remaining installations and spend down).

- **Recommendations**

- **None.**



4. Cost and Schedule

K. Krug, TJNAF, L. Casarole, BNL,
J. Saldivar, DOE/SSO

1. General: Is the project's technical, cost and schedule performance consistent with the Project Execution Plan (PEP) established at CD-3b? **Yes**. Has the project responded appropriately to recommendations from prior reviews? **Yes**. Are there lessons learned from problems encountered during project construction (e.g., lock-out/tag-out and tunneling) that could be shared with the SLI community? **Yes**.

4. Cost and Schedule: Is the project performance in line with the approved performance baseline, and are variances being effectively managed? **Yes**. Is the cost and schedule contingency adequate to complete approved work prior to CD-4? **Yes**. Are project schedules resource loaded and managed for effective performance reporting? **Yes, see recommendation**.



- **Findings**

- The project TPC is \$36M with a TEC of \$34.9M and OPC of \$1.1M
- EVMS statistics as of **31 May 2016**:
 - BCWS: \$20.5M
 - BCWP: \$20.1M
 - ACWP: \$19.5M
 - **BAC: \$33.0M**
 - **EAC: \$32.4M**
 - CPI/SPI: 1.03/.98
 - 61% complete
 - No funding risks as project is fully funded
- Eighteen (18) Baseline Change Requests (BCRs) have been processed through May 2016.
 - \$2.2M drawn from contingency
 - Field changes made up \$460k of the draw
 - **Remaining cost contingency of \$3.0M**
 - **Remaining schedule contingency 17 months**



4. Cost and Schedule

K. Krug, TJNAF, L. Casarole, BNL,
J. Saldivar, DOE/SSO

- **Findings cont'd**
 - **Risk Registry reflects \$1.2M in potential remaining risks with approximately 11.2 months of schedule required**
 - **Potential buy down of \$1.5M for Casey's Pond Pumphouse Addition**
 - **The projected August 2016 start date of the scope enhancement is expected to slip several months bringing schedule contingency to 9 months**
 - The factory testing of the electrical equipment was delayed due to the manufacturer non-performance
- **Comments**
 - Ensure all contractual liabilities remain with ABB when performing on-site factory testing
 - If all risks are realized, the \$1.5M buy down will leave only \$0.3M in contingency to complete the project ($\$3\text{M} - \$1.2\text{M} - \$1.5\text{M} = \0.3M)
 - Project EAC is auto-calculated by their EVM cost system (Cobra) and does not include the Project Manager estimate
 - WBS 600.02 - High Voltage Electrical Upgrade EAC reflects a cost savings of ~\$500k. The vendor contract is Firm Fixed Price and therefore should reflect the full contract value



- **Comments cont'd**
 - Suggest prompt maintenance of the project baseline schedule
 - Timely implementation of BCRs enables schedule confidence
 - There are activities with missing logic
 - Review schedule log (F9) report as a QC step
 - Take advantage of Acumen Fuse
 - Project baseline schedule does not reflect BCR018 or PEP
 - As defined in BCR018, Level 2 milestone “Backbone Pipe from Casey’s Pond to Main Injector Complete” date was delayed from Jun-17 to Aug-17
 - Baseline schedule was not updated as it currently reflects Jun-17
 - The PEP date has been updated to Aug-17



- **Recommendations**
 - Bring baseline schedule in line with approved BCRs and PEP within 30 days or before implementation of future approved change requests.



PROJECT STATUS as of May 31, 2016		
Project Type	Line Item	
CD-1	Planned: Nov 2010	Actual: 11/15/2010
CD-2/3a	Planned: Jan 2015	Actual: 02/18/2015
CD-3b	Planned: Aug 2015	Actual: 09/03/2015
CD-4	Planned: Aug 2017	Actual:
TPC Percent Complete	Planned: 56.9%	Actual: 55.9%
TPC Cost to Date	\$19,523,600	
TPC Committed to Date	\$31,096,333	
TPC	\$36,000,000	
TEC	\$34,900,000	
Contingency Cost (w/Mgmt Reserve)	\$3,026,139	23.6% to go
Contingency Schedule on CD-4b	17 months	36.2% (CD-3a→CD-4)
CPI Cumulative	1.03	
SPI Cumulative	0.98	



5. Management

R. Sprouse, TJNAF / Subcommittee 4
Teresa Danforth, TJNAF Machele Vieux, SLAC

1. General: Is the project's technical, cost and schedule performance consistent with the Project Execution Plan (PEP) established at CD-3b? **Yes**
Has the project responded appropriately to recommendations from prior reviews? **Yes**
Are there lessons learned from problems encountered during project construction (e.g., lock-out/tag-out and tunneling) that could be shared with the SLI community? **Yes**

5. Management: Is the project properly managed for successful completion? **Yes**
Is a contingency spend-down plan developed and executable by CD-4? **Yes**
Are contingency spend-down alternatives prioritized? **Yes**
Is the risk register updated to reflect approved scope enhancements, and are future updates adequately mature for high priority contingency spend-down alternatives? **Yes**



5. Management

R. Sprouse, TJNAF / Subcommittee 4
Teresa Danforth, TJNAF Machele Vieux, SLAC

- **Findings**

- Technical, cost and schedule performance is consistent with the Project Execution Plan (PEP) established at CD-3b.
 - Threshold KPPs have a very high confidence of being achieved.
 - Some Object KPPs have been awarded (345 kV Circuit Breaker and ICW Makeup Water Improvements)
 - The project is being managed within the construction TEC of \$30,450K
 - Additional level 3 milestones were added when approved construction schedules were submitted.
- The Project appropriately responded to recommendations from prior reviews with one exception, development of a detailed Master SubStation (MSS) energization plan. The Project Team indicated this would occur prior to starting up the substation building.
- The Project Team presented lessons learned which was shared both internally to the Lab as well across the complex.



- **Findings (Cont.)**

- Three major contracts have been awarded for execution of two major work elements

Master Substation Control Building Replacement (70% Complete)

Master Sub (MSS) Control Bldg. **94%** Complete

MSS Installation and Site Work **50%** Complete

ICW Backbone Piping Replacement **36%** Complete

- The Project is staffed with an assigned Project Manager and Deputy Project Manager as well as an Associate Project Manager assigned to each of the two project elements. A full time construction coordinator supports both project elements. This Team is well supported by Safety, Quality, Procurement, and Controls.
- All key members of the team are having frequent and regular coordination and collaboration meetings with partners (ComEd) and contractors (ABB, Meade, Whitaker) to identify concerns and resolve before becoming issues.
- The PEP identifies a spend-down plan for use of contingency. The Project Team has developed a spreadsheet of some options for spend-down of contingency which shows a remaining balance of approximately \$900K. The Project Team has indicated that future change orders will absorb the remaining balance.



5. Management

R. Sprouse, TJNAF / Subcommittee 4
Teresa Danforth, TJNAF Machele Vieux, SLAC

- **Findings (Cont.)**
 - The Risk Register has been updated to reflect approved scope enhancements.
 - The design for contingency buy down items is complete and ready for procurement. Bids for these items were previously received and will be rebid when additional buy down items are approved to be exercised. Risk for these by back items are adequately covered in the Risk Register.



5. Management

R. Sprouse, TJNAF / Subcommittee 4
Teresa Danforth, TJNAF Machele Vieux, SLAC

- **Comments**
 - Overall the project is being properly managed.
 - The Project Team has recognized the risk associated with the late delivery of the Master Substation building to the project and other contractors. Daily meetings have been established to monitor and coordinate remaining work. The Project Management team has changed the payment milestone (\$1.5M) from successful Factory Accepted Testing to Site Acceptance Testing. SAT is anticipated to start and complete in August. Payment to the MSS subcontractor, ABB, will not be made until successful SAT.
 - One mitigation to the late delivery of the MSS may be to invoke liquidated damages, however this process may be difficult to execute if delays are not clearly and explicitly identified and documented as contractor caused delay.
 - There is uncertainty in the final cost of the ICW contract due additional cost related to increased unit priced item quantities. The lab staff indicated the more critical work has been completed and remaining work is anticipated to be closer or equal to the estimated quantities.



5. Management

R. Sprouse, TJNAF / Subcommittee 4
Teresa Danforth, TJNAF Machelie Vieux, SLAC

- **Comments**
 - There is concern with regard to timing of the next BCR which would include the Casey Pond Pump Station. Award of the Casey Pond Pump House scope enhancement would put the activity on the critical path. There is one risk related to the Casey Pond Pump House is identified in the risk register.
 - An update of the remaining schedule and risk register to identify when risks are expected to retire and probability of retiring risk would provide a higher confidence level as to what remaining risks lie ahead and how the risks will be retired as construction progresses.
 - A Failure Mode and Effects Analysis of the construction of the Casey Pond Pump Station would be beneficial in determining if all appropriate risk have been identified.



- **Recommendations**
 - Update risk Register to ensure risk associated with remaining work is appropriately address and identify when risk will be retired and align this with the remaining contingency. Update the Use of Contingency and Management Reserve spreadsheet to reflect planned use and schedule for the remaining contingency. Complete prior to submission of the BCR.
 - Update the Use of Contingency and Management Reserve spreadsheet to reflect a final balance of zero or less. Add lines for expected use of contingency through the remainder of the project including field changes. Complete prior to submission of the BCR.